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(54) **DEVICE TO ABSORB ENERGY TRANSMITTED THROUGH STEERING COLUMN FOR A VEHICLE**

VORRICHTUNG ZUR ABSORBIERUNG VON,VON DER FAHRZEUGLENKSÄULE ÜBERMITTELTER ENERGIE

DISPOSITIF SERVANT A ABSORBER L'ENERGIE TRANSMISE A TRAVERS LA COLONNE DE DIRECTION D'UN VEHICULE

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Description

This invention relates to a device to absorb energy transmitted through a steering column for a vehicle in the event of vehicle crash and/or driver impact on the steering wheel.

A known problem has been one of how to absorb chest impact energies in a vehicle steering column which is rake and reach adjustable. Designs in existence tend to rely on crushing or extending a convoluted tube, which have the problem of relatively high tool cost and low natural frequency.

Figures 1 to 3 (which show a device such as defined in the preamble of claim 1) schematically illustrate the problem and it will be seen that the problem is caused by the upper part 1 of the steering column having to move up and down and in and out relative to the supporting bracketry 2, thereby preventing the use of a fixed energy absorbing portion between them. The lines indicated generally by the reference numeral 3 indicate various steering wheel positions attainable by the adjustable upper steering column, whilst the arrow A illustrates the direction of driver impact in the event of a vehicle crash.

The steering wheel 3 is held in the desired position by means of a clamping mechanism 4 which typically comprises a bolt 5, a mounting bracket 6 to hold the steering column to the vehicle, a saddle bracket 7 which locates an outer tube of the upper steering column 1 and can be of a wrap around type or simply located underneath, and an operating handle 8 to lock and unlock the clamping mechanism 4. A support member 9 is provided to prevent the saddle bracket 7 from crushing when clamped. As can be seen in Figure 3, the bolt 5 is freely located in pairs of slots 10 both in the mounting bracket 6 and the saddle bracket 7.

With this prior construction, if the driver's chest impacts the steering wheel 3, the bolt 5 is caused to bottom out at one end of each slot 10, at which point the convoluted portion of the steering column tube starts to collapse or extend.

According to the present invention, there is provided a device to absorb energy transmitted through an adjustable steering column for a vehicle in the event of a vehicle crash and/or driver impact on the steering wheel, the device including an adjustment mechanism comprising a first slotted member for connection to a steering column for reach adjustment thereof, the first slotted member having two spaced-apart walls each with a slot therein, a second member extending through the slots of said first member, said second member being utilised to clamp the adjusting mechanism, and a third member extending between the walls of the first member to support same, characterised in that said third member is arranged to restrict relative movement between said first and second members upon vehicle crash and/or driver impact on the steering wheel, said third member being in the form of a strap-like member which is wrapped over the second member in such a manner as to provide said restricted relative movement, whilst being engageable at the wrapped over end thereof by the second member upon vehicle crash and/or driver impact, so that the strap-like member unwraps and plastically deforms, thereby absorbing energy transmitted through the steering column.

The invention extends to a vehicle steering column incorporating a device essentially as defined in the preceding paragraph.

Preferably, the slot is open-ended so that the second member leaves the slot upon vehicle crash and/or driver impact.

Preferably, the second member is a bolt or similar member.

Preferably, the third member is in the form of a strap-like member which is wrapped over the second member so that it unwraps and plastically deforms upon vehicle crash and/or driver impact, thereby absorbing energy.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to Figures 4 to 7 of the accompanying drawings (and again to Figure 1), in which:-

Figure 4 is a diagrammatic perspective view showing the first, second and third members prior to vehicle crash and/or driver impact on the steering wheel,

Figure 5 is a view similar to Figure 4 showing the state of the members as energy is absorbed from the steering column,

Figure 6 is a general assembly side view of an upper portion of the steering column,

Figure 7 is a diagrammatic plan view of the device, and

Figure 8 is a graph of load against distance of the reaction of the second member against the third member as the latter unwraps, when the third member is provided with a slot along part of its length.

Referring to Figures 1 and 4 to 8, it will be seen that the first member comprises the saddle bracket 7 but in this case, the pairs of slots are formed as slots 11, each with an open end 11A.

The second member is the bolt 5 which, when the clamping mechanism 4 is released, is able to run freely in the slot 11 for adjustment of the steering wheel 3 in and out.

The third member as defined hereinabove is provided by a modified support member 9 which is illustrated in Figures 4, 5 and 6 by a bent-over supporting strap 12 which has a slot 12A extending in from one end of it. In

Figures 4 and 5, the tube 1 and bracketry 2 have been omitted for clarity.

In the present case, there is no need to provide a convoluted steering column tube which is thus replaced by a straight tube.

It will be seen that the supporting strap 12, which is stiff but ductile, is effectively wrapped over itself such that it runs underneath and over the bolt 5. Figure 4 shows the bolt near the open end of the slot 11 and just contacting the strap 12.

Upon vehicle crash and/or driver impact on the steering wheel which will cause the steering column 1 to collapse, the bolt 5 will move in a direction out of the slot 11 and it runs into the wrapped-over portion of the strap 12 as it leaves the slot 11 and the force exerted on the bolt 5 during such crash and/or impact then causes the support strap 12 to unwrap as shown in Figure 5, thereby absorbing energy transmitted through the steering column.

The actual design of the device can be tuned to the desired requirements since vehicles tend to require their own individual column crash load curves. Modifications can therefore be made to the thickness of, for example, the strap 12 and the materials incorporated in the device. Another feature which can affect the basic load curve is the addition of the slot 12A and the length of that slot 12A can be used to affect the shape of the load curve.

Figure 8 gives a simple example of load against distance with point X showing a condition where the bolt is being applied against the strap 12 where there is no slot 12A, whilst the level Y shows the bolt 5 being applied against the strap 12 where the slot 12A is located.

It will be appreciated that the present device is capable of being incorporated in a collapsible steering column that is rake and/or reach adjustable but can equally well be incorporated in tilting steering columns.

Again, arrow A in Figure 7 shows the impact direction.

It will be further appreciated that the second member can be in forms other than the bolt 5 shown, and the third member can be any suitable profile to match.

By moving the supporting strap 12 relatively to the saddle bracket 7, it will be appreciated that the achievable length of steering column adjustment can be regulated, whilst the length of the steering column collapse can be controlled by the length and shape of the third member (strap 12).

The device can be situated and will function whether it is underneath or on top of the steering column outer tube 1.

Furthermore, the device allows the use of a much more rigid upper tube, thereby increasing the natural frequency of the steering column.

Claims

1. A device to absorb energy transmitted through an adjustable steering column (1) for a vehicle in the event of a vehicle crash and/or driver impact on the steering wheel, the device including an adjustment mechanism comprising a first slotted member (7) for connection to a steering column for reach adjustment thereof, the first slotted member having two spaced-apart walls each with a slot (11) therein, a second member (5) extending through the slots (11) of said first member, said second member being utilised to clamp the adjusting mechanism, and a third member (12) extending between the walls of the first member (7) to support same, characterised in that said third member (12) is arranged to restrict relative movement between said first and second members upon vehicle crash and/or driver impact on the steering wheel, said third member being in the form of a strap-like member (12) which is wrapped over the second member (5) in such a manner as to provide said restricted relative movement, whilst being engageable at the wrapped over end thereof by the second member (5) upon vehicle crash and/or driver impact, so that the strap-like member (12) unwraps and plastically deforms, thereby absorbing energy transmitted through the steering column (1).

2. A device according to claim 1, wherein said slot (11) is open-ended so that the second member (5) leaves the slot upon vehicle crash and/or driver impact.

3. A device according to claim 1 or 2, wherein the second member is a bolt (5) or the like.

4. A device according to claim 1, 2 or 3, wherein the third member is itself slotted (12A) so as to provide a desired energy absorbtion characteristic.

5. A vehicle steering column incorporating a device according to any one of the preceding claims.

6. A vehicle steering column according to claim 5, wherein it is rake adjustable.

7. A vehicle steering column according to claim 5 or 6, wherein it is reach adjustable.

Patentansprüche

1. Vorrichtung zum Absorbieren von Energie, die durch eine einstellbare Lenksäule (1) für ein Fahrzeug im Falle eines Fahrzeugaufpralls und/oder eines Fahreraufpralls auf das Lenkrad übertragen wird, wobei die Vorrichtung einen Einstellmechanis-

mus aufweist, der ein erstes geschlitztes Glied (7) zum Verbinden mit einer Lenksäule für deren Bereichseinstellung hat, wobei das erste geschlitzte Glied zwei voneinander beabstandete Wände mit jeweils einem Schlitz (11) darin hat, mit einem zweiten Glied (5), das sich durch die Schlitze (11) des ersten Gliedes hindurch erstreckt, wobei das zweite Glied dazu dient, den Einstellmechanismus festzuklemmen, und mit einem dritten Glied (12), das sich zwischen den Wänden des ersten Glieds (7) erstreckt, um dasselbe abzustützen, **dadurch gekennzeichnet,** daß das dritte Glied (12) so angeordnet ist, daß es eine relative Bewegung zwischen den ersten und zweiten Gliedern nach einem Fahrzeugaufprall und/oder nach einem Aufprall des Fahrers auf das Lenkrad begrenzt, wobei das dritte Glied die Form eines bügelartigen Gliedes (12) hat, das über das zweite Glied (5) in einer solchen Weise gewickelt ist, daß es die begrenzte relative Bewegung schafft, während es an seinem umgewikkelten Ende durch das zweite Glied (5) bei einem Fahrzeugaufprall und/oder einem Fahreraufprall zum Eingriff kommt, so daß das bügelartige Glied (12) sich aufwickelt und sich plastisch verformt, wodurch es Energie absorbiert, die durch die Lenksäule (1) übertragen wird.

2. Vorrichtung nach Anspruch 1, bei der der Schlitz (11) ein offenes Ende hat, so daß das zweite Glied (5) den Schlitz bei einem Fahrzeugaufprall und/oder einem Fahreraufprall verläßt.

3. Vorrichtung nach Anspruch 1 oder 2, bei dem das zweite Glied ein Bolzen (5) oder dergleichen ist.

4. Vorrichtung nach Anspruch 1, 2 oder 3, bei dem das dritte Glied selbst geschlitzt (12A) ist, so daß es eine gewünschte Energieabsorbtions-Charakteristik hat.

5. Fahrzeuglenksäule mit einer Vorrichtung nach einem der vorhergehenden Ansprüche.

6. Fahrzeuglenksäule nach Anspruch 5, die in der Neigung einstellbar ist.

7. Fahrzeuglenksäule nach Anspruch 5 oder 6, die in der Reichweite einstellbar ist.

Revendications

1. Dispositif pour absorber l'énergie transmise à travers une colonne de direction de véhicule réglable (1) dans le cas d'une collision du véhicule et/ou du choc d'impact sur le volant de direction, le dispositif comprenant un mécanisme de réglage qui comprend lui-même un premier élément fendu (7) destiné à être relié à la colonne de direction pour permettre le réglage de celle-ci en longueur, le premier élément fendu ayant deux parois espacées, chacune munie d'une fente (11), un deuxième élément (5) qui s'étend à travers les fentes (11) dudit premier élément, ledit deuxième élément étant utilisé pour serrer le mécanisme de réglage, et un troisième élément (12) qui s'étend entre les parois du premier élément (7) pour étayer celui-ci, caractérisé en ce que ledit troisième élément (12) est agencé pour restreindre le déplacement relatif entre les premier et deuxième éléments en présence d'une collision du véhicule et/ou de l'impact du conducteur sur le volant de direction, ledit troisième élément étant sous la forme d'un élément en forme de collier (12) qui est recourbé par dessus le deuxième élément (5) de manière à déterminer ledit mouvement relatif restreint, cependant qu'il peut être attaqué par le deuxième élément (5) au niveau de son extrémité recourbée, en réponse à une collision du véhicule et/ou à un impact du conducteur, de sorte que l'élément en forme de collier (12) se déroule et se déforme par déformation plastique, en absorbant ainsi l'énergie transmise à travers la colonne de direction (1).

2. Dispositif selon la revendication 1, dans lequel ladite fente (11) est ouverte à son extrémité, de sorte que le deuxième élément (5) quitte la fente à la suite d'une collision du véhicule et/ou d'un impact du conducteur.

3. Dispositif selon la revendication 1 ou 2, dans lequel le deuxième élément est un boulon (5) ou analogue.

4. Dispositif selon la revendication 1, 2 ou 3, dans lequel le troisième élément est lui-même fendu (12A) de manière à donner une caractéristique d'absorption d'énergie désirée.

5. Colonne de direction du véhicule comportant un dispositif selon une quelconque des revendications précédentes.

6. Colonne de direction de véhicule selon la revendication 5, qui est réglable en angle.

7. Colonne de direction de véhicule selon la revendication 5 ou 6, qui est réglable en longueur.

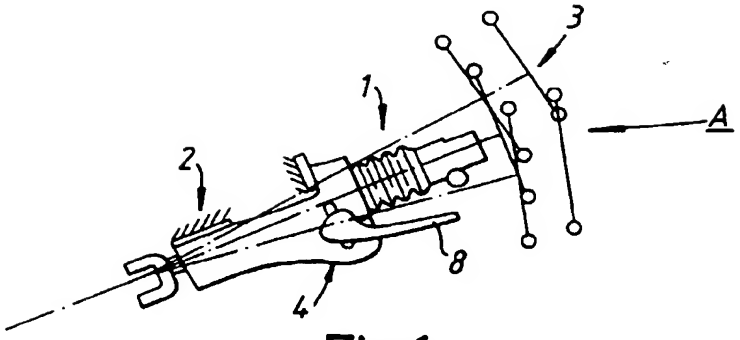

Fig.1.

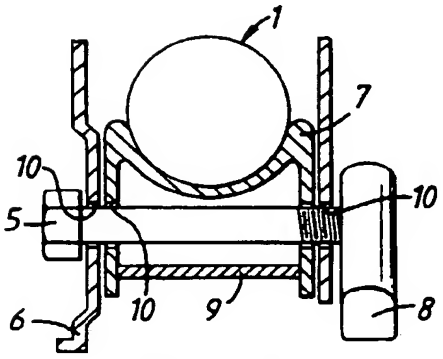

Fig.2.

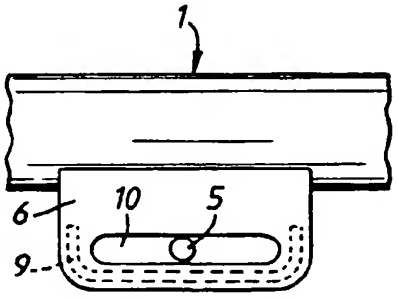

Fig.3.

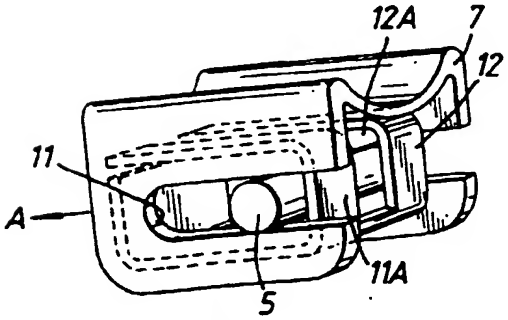

Fig.4.

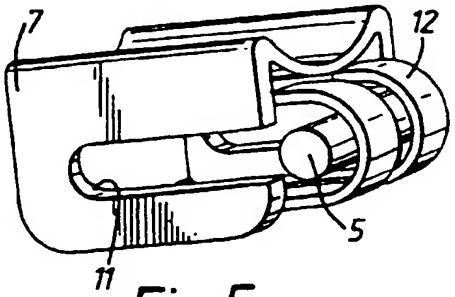

Fig.5.

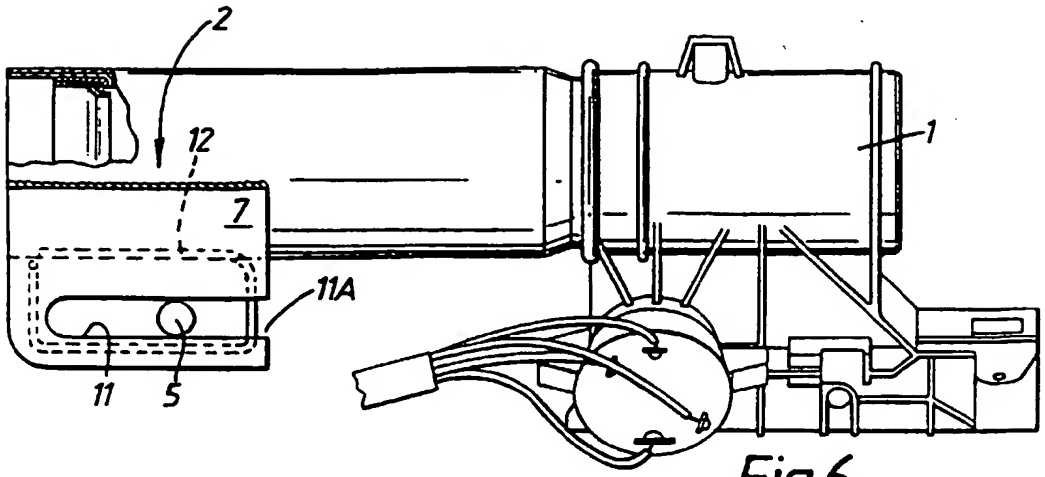

Fig.6.

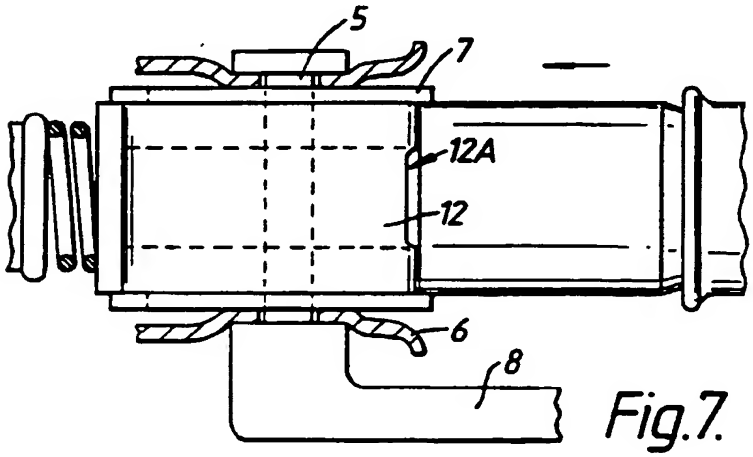

Fig.7.

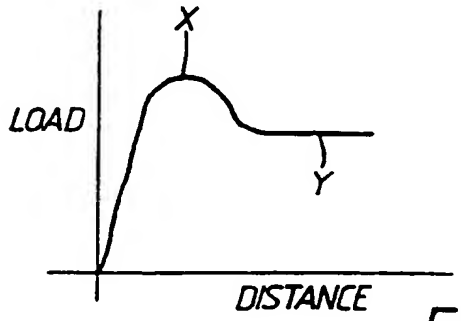

Fig.8.